

1. To the lines  $ax^2 + 2hxy + by^2 = 0$ , the lines  $a^2x^2 + 2h(a+b)xy + b^2y^2 = 0$  are  
 (a) equally inclined  
 (b) perpendicular  
 (c) bisector of the angle  
 (d) None of the above
2. If  $R$  be a relation from  $A = \{1, 2, 3, 4\}$  to  $B = \{1, 3, 5\}$  such that  $(a, b) \in R \Leftrightarrow a < b$ , then  $R \circ R^{-1}$  is  
 (a)  $\{(1, 3), (1, 5), (2, 3), (2, 5), (3, 5), (4, 5)\}$   
 (b)  $\{(3, 1), (5, 1), (3, 2), (5, 2), (5, 3), (5, 4)\}$   
 (c)  $\{(3, 3), (3, 5), (5, 3), (5, 5)\}$   
 (d)  $\{(3, 3), (3, 4), (4, 5)\}$
3. If  $x + iy = (1 - i\sqrt{3})^{100}$ , then find  $(x, y)$ .  
 (a)  $(2^{99}, 2^{99}\sqrt{3})$  (b)  $(2^{99}, -2^{99}\sqrt{3})$   
 (c)  $(-2^{99}, 2^{99}\sqrt{3})$  (d) None of these
4. For a GP,  $a_n = 3(2^n)$ ,  $\forall n \in N$ . Find the common ratio.  
 (a) 2 (b)  $1/2$   
 (c) 3 (d)  $1/3$
5. If  $a, b, c$  are in HP, then  $\frac{a}{b+c}, \frac{b}{c+a}, \frac{c}{a+b}$  will be in  
 (a) AP (b) GP  
 (c) HP (d) None of these
6. If  $\frac{x^2 + 2x + 7}{2x + 3} < 6$ ,  $x \in R$ , then  
 (a)  $x > 11$  or  $x < -\frac{3}{2}$   
 (b)  $x > 11$  or  $x < -1$   
 (c)  $-\frac{3}{2} < x < -1$   
 (d)  $-1 < x < 11$  or  $x < -\frac{3}{2}$
7. The number of ways of painting the faces of a cube of six different colours is  
 (a) 1 (b) 6  
 (c)  $6!$  (d) 36
8. A line passes through  $(2, 2)$  and is perpendicular to the line  $3x + y = 3$ . What is its  $y$ -intercept?  
 (a)  $1/3$  (b)  $2/3$   
 (c) 1 (d)  $4/3$
9. The number of common tangents to the circles  $x^2 + y^2 = 4$  and  $x^2 + y^2 - 6x - 8y = 24$  is  
 (a) 0 (b) 1  
 (c) 3 (d) 4
10. If  $D$  is the set of all real  $x$  such that  $1 - e^{(1/x)-1}$  is positive, then  $D$  is equal to  
 (a)  $(-\infty, 1]$  (b)  $(-\infty, 0)$   
 (c)  $(1, \infty)$  (d)  $(-\infty, 0) \cup (1, \infty)$
11. Find the value of the limit  $\lim_{x \rightarrow 0} \frac{\sqrt{1 - \cos x}}{x}$ .  
 (a) 0 (b) 1  
 (c)  $\sqrt{2}$  (d) does not exist
12. Evaluate  $\int \frac{x^2 + 4}{x^4 + 16} dx$ .  
 (a)  $\frac{1}{2\sqrt{2}} \tan^{-1} \left( \frac{x^2 - 4}{2x\sqrt{2}} \right) + C$   
 (b)  $\frac{1}{2\sqrt{2}} \tan^{-1} \left( \frac{x^2 - 4}{2\sqrt{2}} \right) + C$   
 (c)  $\frac{1}{2\sqrt{2}} \tan^{-1} \left( \frac{x^2 - 4}{x\sqrt{2}} \right) + C$   
 (d) None of the above
13. Evaluate  $\int_{\pi/4}^{3\pi/4} \frac{1}{1 + \cos x} dx$   
 (a) 2 (b) -2  
 (c)  $1/2$  (d)  $-1/2$
14. If one AM 'A' and two GM  $p$  and  $q$  are inserted between two given numbers, then find the value of  $\frac{p^2}{q} + \frac{q^2}{p}$ .  
 (a) A (b) 2A  
 (c) 3A (d) 4A
15. If the roots of the equation  $x^2 + ax + b = 0$  are  $c$  and  $d$ , then one of the roots of the equation  $x^2 + (2c + a)x + c^2 + ac + b = 0$  is  
 (a)  $c$  (b)  $d - c$   
 (c)  $2d$  (d)  $2c$
16. The sum of the coefficients of  $(6a - 5b)^n$ , where  $n$  is a positive integer, is  
 (a) 1 (b) -1  
 (c)  $2^n$  (d)  $2^{n-1}$

17. Find the value of  $(7.995)^{1/3}$  correct to four decimal places.  
 (a) 1.9995 (b) 1.9996  
 (c) 1.9990 (d) 1.9991
18. The values of constants  $a$  and  $b$  so that  $\lim_{x \rightarrow \infty} \left( \frac{x^2 + 1}{x + 1} - ax - b \right) = 0$  are  
 (a)  $a = 0, b = 0$   
 (b)  $a = 1, b = -1$   
 (c)  $a = -1, b = 1$   
 (d)  $a = 2, b = -1$
19. The projection of the vector  $\mathbf{i} - 2\mathbf{j} + \mathbf{k}$  on the vector  $4\mathbf{i} - 4\mathbf{j} + 7\mathbf{k}$  is  
 (a)  $\frac{5\sqrt{6}}{10}$  (b)  $\frac{19}{9}$   
 (c)  $\frac{9}{19}$  (d)  $\frac{\sqrt{6}}{19}$
20. If  $\mathbf{a}, \mathbf{b}, \mathbf{c}$  are three non-zero vectors such that  $\mathbf{a} + \mathbf{b} + \mathbf{c} = \mathbf{0}$  and  $m = \mathbf{a} \cdot \mathbf{b} + \mathbf{b} \cdot \mathbf{c} + \mathbf{c} \cdot \mathbf{a}$ , then  
 (a)  $m < 0$  (b)  $m > 0$   
 (c)  $m = 0$  (d)  $m = 3$
21. A line making angles  $45^\circ$  and  $60^\circ$  with the positive directions of the axes of  $x$  and  $y$  makes with the positive direction of  $z$ -axis, an angle of  
 (a)  $60^\circ$  (b)  $120^\circ$   
 (c)  $60^\circ$  or  $120^\circ$  (d) None of these
22. If  $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ ,  $J = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$  and  $B = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$ , then  $B$  is equal to  
 (a)  $I \cos \theta + J \sin \theta$   
 (b)  $I \sin \theta + J \cos \theta$   
 (c)  $I \cos \theta - J \sin \theta$   
 (d)  $-I \cos \theta + J \sin \theta$
23. Which of the following is correct?  
 (a) Determinant is a square matrix  
 (b) Determinant is a number associated to a matrix  
 (c) Determinant is a number associated to a square matrix  
 (d) All of the above
24. If  $\alpha, \beta$  and  $\gamma$  are the roots of  $x^3 + ax^2 + b = 0$ , then the value of  $\begin{vmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{vmatrix}$  is  
 (a)  $-a^3$  (b)  $a^3 - 3b$   
 (c)  $a^3$  (d)  $a^2 - 3b$
25. If the axes are shifted to the point  $(1, -2)$  without solution, then the equation  $2x^2 + y^2 - 4x + 4y = 0$  becomes  
 (a)  $2X^2 + 3Y^2 = 6$   
 (b)  $2X^2 + Y^2 = 6$   
 (c)  $X^2 + 2Y^2 = 6$   
 (d) None of the above
26. If  $f(x) = \begin{cases} x^2, & x \leq 0 \\ 2 \sin x, & x > 0 \end{cases}$ , then  $x = 0$  is  
 (a) point of minima  
 (b) point of maxima  
 (c) point of discontinuity  
 (d) None of the above
27. In a group  $(G, *)$ , then equation  $x * a = b$  has a  
 (a) unique solution  $b * a^{-1}$   
 (b) unique solution  $a^{-1} * b$   
 (c) unique solution  $a^{-1} * b^{-1}$   
 (d) many solutions
28. A die is rolled twice and the sum of the numbers appearing on them is observed to be 7. What is the conditional probability that the number 2 has appeared at least once?  
 (a)  $\frac{1}{2}$  (b)  $\frac{1}{3}$   
 (c)  $\frac{2}{3}$  (d)  $\frac{2}{5}$
29. The locus of the mid-points of the focal chord of the parabola  $y^2 = 4ax$  is  
 (a)  $y^2 = a(x - a)$  (b)  $y^2 = 2a(x - a)$   
 (c)  $y^2 = 4a(x - a)$  (d) None of these
30. Find the value of  $\sin 12^\circ \sin 48^\circ \sin 54^\circ$ .  
 (a)  $\frac{1}{2}$  (b)  $\frac{1}{4}$   
 (c)  $\frac{1}{6}$  (d)  $\frac{1}{8}$

31. In an equilateral triangle, the inradius, circumradius and one of the exradii are in the ratio  
 (a) 2 : 3 : 5  
 (b) 1 : 2 : 3  
 (c) 1 : 3 : 7  
 (d) 3 : 7 : 9
32. Let  $p$  and  $q$  be two statements. Then,  $p \vee q$  is false, if  
 (a)  $p$  is false and  $q$  is true  
 (b) both  $p$  and  $q$  are false  
 (c) both  $p$  and  $q$  are true  
 (d) None of the above
33. In how many ways 6 letters be posted in 5 different letter boxes?  
 (a)  $5^6$  (b)  $6^5$   
 (c)  $5!$  (d)  $6!$
34. If  $A$  and  $B$  be two sets such that  $A \times B$  consists of 6 elements. If three elements  $A \times B$  are  $(1, 4)$ ,  $(2, 6)$  and  $(3, 6)$ , find  $B \times A$ .  
 (a)  $\{(1, 4), (1, 6), (2, 4), (2, 6), (3, 4), (3, 6)\}$   
 (b)  $\{(4, 1), (4, 2), (4, 3), (6, 1), (6, 2), (6, 3)\}$   
 (c)  $\{(4, 4), (6, 6)\}$   
 (d)  $\{(4, 1), (6, 2), (6, 3)\}$
35. Let  $f : R \rightarrow R$  be defined as  $f(x) = x^2 + 1$ , find  $f^{-1}(-5)$ .  
 (a)  $\{\phi\}$   
 (b)  $\phi$   
 (c)  $\{5\}$   
 (d)  $\{-5, 5\}$
36. If  $X$  is a poisson variate such that  $P(X = 1) = P(X = 2)$ , then  $P(X = 4)$  is equal to
- (a)  $\frac{1}{2e^2}$  (b)  $\frac{1}{3e^2}$   
 (c)  $\frac{2}{3e^2}$  (d)  $\frac{1}{e^2}$
37. The area enclosed by  $y = 3x - 5$ ,  $y = 0$ ,  $x = 3$  and  $x = 5$  is  
 (a) 12 sq units  
 (b) 13 sq units  
 (c)  $13\frac{1}{2}$  sq units  
 (d) 14 sq units
38. The order and degree of the differential equation  $\left(1 + 4\frac{dy}{dx}\right)^{2/3} = 4\frac{d^2y}{dx^2}$  are respectively  
 (a) 1,  $\frac{2}{3}$  (b) 3, 2  
 (c) 2, 3 (d) 2,  $\frac{2}{3}$
39. The solution of the differential equation  $\frac{dy}{dx} = (4x + y + 1)^2$ , is  
 (a)  $(4x + y + 1) = \tan(2x + C)$   
 (b)  $(4x + y + 1)^2 = 2 \tan(2x + C)$   
 (c)  $(4x + y + 1)^3 = 3 \tan(2x + C)$   
 (d)  $(4x + y + 1) = 2 \tan(2x + C)$
40. The system of equations  $2x + y - 5 = 0$ ,  $x - 2y + 1 = 0$ ,  $2x - 14y - a = 0$ , is consistent. Then,  $a$  is equal to  
 (a) 1 (b) 2  
 (c) 5 (d) None of these

### Answer Key

1. a	2. c	3. c	4. a	5. c	6. d	7. a	8. d	9. b	10. d
11. d	12. a	13. a	14. b	15. b	16. a	17. b	18. b	19. b	20. a
21. a	22. a	23. c	24. c	25. b	26. a	27. a	28. b	29. b	30. d
31. b	32. b	33. a	34. b	35. b	36. c	37. d	38. c	39. d	40. d